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Space Station Models, Mockups,  
and Simulators

LSS-1224

by

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Space Station Human Productivity Working Group Meeting

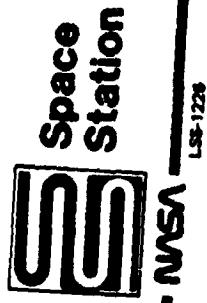
NASA-Ames Research Center

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NASA — LSS-1225

- Types of Boeing models, mockups and simulators
- Classes of models, mockups and simulators
- Use of models in 767 program
- Use of models, mockups, and simulators for  
Space Station Program



## Types of Boeing Models, Mockups, and Simulators

- **Stationary work stations** – Flight decks, E-3A multipurpose consoles, communications consoles, gunner stations etc.
- **Larger work areas** – Galleys, cargo handling, E-3A & E-4B mission crew areas, maintenance areas
- **Leisure areas** – Airplane passenger cabins, lavatories, E-3A & E-4B rest areas
- **Complete facility** – Airplane, office and production areas



Space  
Station

## Classes of Models, Mockups and Simulators

NASA

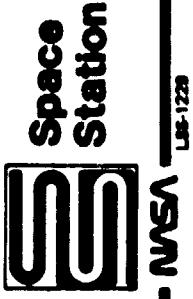
US-1227

Class	Use	Users
<u>Models</u>		
1/100th-1/20th scale	- Compare variety of concepts	Staff and engineering
1/10-1/4th scale	- Area layout and access	
	- Personnel accommodation	
<u>Full scale mockups</u>		
Class 1	- Progressive development of design	
	- Foam core, wood & paper of overall configuration	Staff and engineering
	- Subsystems mockup (plumbing, wiring)	
Class 2	- Lighting, display and control	
	- Rea. equipment & materials	Manufacturing
	(not qualified)	
“Lighted” mockup		
Class 3		
<u>Engineering simulators</u>	- Develop and test design and procedures	Engineering
<u>Developmental Configuration</u>	- Single task or subsystem	
	- Integrated tasks, and subsystems	
<u>Training devices</u>	- Train and test personnel	Training
Part task trainers	- Single task	
Procedures trainers	- Integrate tasks	
Training simulators	- Realistic situation	



## Characteristics of Models

- Inexpensive side by side comparison of concepts and designs
  - Humans much better at comparative judgments than absolute judgments
  - Provides 3-D views and perspective
  - Easy to transport
- Used by technical staff, engineering, marketing research and public relations
- Range of model scales
  - 1/100th - 1/20th scale      - Area layout and access
  - 1/10th - 1/4th scale      - Component layout and personnel accommodation
- Evaluations of interior layouts and color schemes closely approximate evaluations of actual interiors



## Use of Models for 767 Program

- Verification of value of models for design evaluation
- Evaluation of alternative passenger cabin configurations
- Prediction of 767 market share in competitive markets
- Demonstration of 767 passenger appeal to airlines



## Computerized Human Factors Tools

- Analyses for anticipated user groups
- Conducted before hardware built
- Anthropometry
  - Accessibility of controls
- Vision
  - Readability of displays
  - Vision through windows
- Timeline evaluation



## Approach for Space Station

- Maximize use of CAD/CAM
  - Concept development and evaluation
  - Early problem identification and resolution
- Maximize use of models
  - Comparison of alternative concepts
  - Initial development of procedures
- Initial training
  - Use partial mockups, subsystem simulators, and part task trainers to maximum utilization
- Minimize demands on complete mockups, engineering simulators and training simulators